REMARKS

The present response is intended to be fully responsive to the rejection raised in the Office Action, and is believed to place the application in condition for allowance. Further, the Applicants do not acquiesce to any portion of the Office Action not particularly addressed. Favorable reconsideration and allowance of the application is respectfully requested.

In the Office Action, the Office noted that claims 1, 3-19 and 21-29 are pending, and that claims 1, 3-19 and 21-29 are rejected. The Office objected to claims 1 and 19. In view of the above amendments and the following discussion, the Applicants submit that none of the claims now pending in the application are anticipated under the provisions of 35 U.S.C. §102 or obvious under the provisions of 35 U.S.C. §103. Thus, Applicants believe that all of these claims are now in condition for allowance.

I. OBJECTIONS

The Office objected to claims 1 and 19 because of minor informalities. The Applicants have amended claims 1 and 19 to correct these minor informalities. Thus, the Applicants submit that claims 1 and 19 are allowable, and in turn, request that the objection to such claims be withdrawn.

In addition, the Applicants submit that no new matter has been added by way of the above amendment.

II. REJECTIONS

A. Response to §103(a) Rejection of Claims 1, 3-19, and 21-29

The Office rejected claims 1, 3-19, and 21-29 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Publication No. 2005/0086469 A1 by Dunagan ("*Dunagan*") and U.S. Patent Publication No. 2004/0054807 A1 by Harvey ("*Harvey*"), in view of U.S. Patent No. 6,282,170 B1 issued to Bentall ("*Bentall*"). The Applicants respectfully traverse this rejection.

The Office alleges that a combination of the cited references teach or suggest each and every limitation of the Applicants' invention as recited in independent claims 1, 17, 18 and 19. See Final Office Action, pg. 2-3 and 6-7. The Office contends that Harvey discloses determining an ordering for a plurality of N nodes such that the nodes are circularly ordered as nodes D_0, D_1, D_2, ... D_{N-1} and that each node D_i in the plurality of nodes establishing a link to X other nodes chosen as nodes D_{i+1}, D_{i+2}, ... D_{i+X}, wrapping to D_0 if necessary. See Final Office Action, pg. 2-3, citing Harvey at Fig. 9. The Office states that Dunagan discloses that each node D_j in at least a subset of the plurality of nodes establishing a link with one or more additional chosen nodes not in the set D_{j-X}. D_{j-X1} ...D_{j-1}, D_{j1}, D_{j+2}, ... D_{j+X}. See Id., citing Dunagan at para [0071]-[0072]. With respect to claim 17, the Office purports that Dunagan discloses that for each node D_j in at least a subset of the plurality of nodes the node D_j establishing a link with one or more randomly chosen nodes not in the set D_{j-X}, D_{j-X+1}, ... D_{j-1}, D_{j+1}, D_{j+2}, ... D_{j+X}. See Final Office Action, pg 6-7, citing Dunagan at para [0071]-[0072].

The Office admits that Dunagan and Harvey do not disclose that for each node D_j in the at least the subset, each node in the set D_{j-x}, D_{j-x+1}, ... D_{j-1}, D_{j+1}, D_{j+2} ... D_{j+X} establishing a link with the one or more additional nodes chosen by the node D_j. See Final Office Action, pg. 2-3. The Office states that Bentall shows in fig. 23 node 152 establishing a link with node 155 and nodes 151 and 153 also establishing a connection with node 155. See Id., citing Bentall at Fig. 23. The Office concludes that it would be have obvious to one of ordinary skill in the art to modify the fault tolerant notification method of Dunagan and Harvey with a restoration path method as disclosed by Bentall and to make the combination to set up a new virtual path to avoid the failed-part. See Id., citing Bentall at col. 8 lines 28-33. The Applicants' respectfully disagree.

Harvey generally teaches a system and method for creating and maintaining an improved overlay network for peer-to-peer systems with an efficient distributed data structure that uses sorted data records and pointers that skip over various numbers of data records, such as a SkipNet or a SkipList. See Harvey, at para [0061]-[0071] and para [0154]-[0166]. The SkipNet differs from the SkipList in that instead of having nodes store a highly variable number of pointer, each SkipNet node stores roughly 2 log N where N is the number of nodes in the SkipNet. See Harvey, at para [0162]. The

SkipNet may be used to avoid some of the disadvantages of distributed hash tables by organizing data by key ordering. See Harvey, at para [0061]-[0083] and para [0154]-[0166]. SkipNets can use logarithmic state per node and probabilistically support searches, insertions and deletions in logarithmic time. Id.

Dunagan generally discloses a scalable, fault-tolerant, federated event notification method is described, wherein clients express interest in a topic by subscribing, and published event notifications are delivered to all current topic-subscribers through a SkipNet or an overlay network. See Dunagan, at para [0050]-[0063]. Event notifications are disseminated by a multicast infrastructure utilizing the SkipNet's path locality features. Id.

Dunagan incorporates the teachings of Harvey by reference. See Dunagan, at para [0058]. Accordingly, Dunagan teaches or suggests the use of a SkipNet overlay network or a Skiplist data structure in a multicast infrastructure. See Dunagan, at para [0058]-[0060]. The SkipNet is a type of network where 2^h nodes are skipped (i.e., no link established) for every h levels. See Harvey, at para [0161]-[0163]. The SkipNet overlay network ensures path locality where overlay routing paths between nodes only traverses nodes that belong to the same administrative domain. See Dunagan, at para [0058]-[0060]. The SkipNet overlay networks permits string identifiers at the node to indicate the administrative domain that owns the node. Id. Dunagan employs the SkipNet overlay network to constrain multicast dissemination trees to a specific administrative domain. Id. As such, the SkipNet overlaw network prohibits nodes within the multicast tree owned by a first organization from depending on nodes owned by a second organization to forward messages from other first organization nodes. See Dunagan, at para [0060]-[0062].

Bentall is directed to network restoration routing optimization. See Bentall, Figs. 3-8, at col 5 ln 47 to col 7 ln 57. Bentall generally teaches that following failure of part of the network, a restoration process is carried out. See Bentall, at col 9 ln 52 to col 18 ln 5. A restoration route around the failed part of the network and allocates the capacity of links along the restoration route. See Bentall, at Figs. 8-16, col. 10 ln 13 to col 11 ln 67. An optimization algorithm may be applied to the restoration route to eliminate any loops or to use routes further away from the failed node or nodes to avoid congestion

near to the failed node or nodes. See Bentall, at Figs. 16-23, col. 11 ln 61 to col 16 ln 62.

Hence, the combination of the cited references Dunagan, Harvey and Bentall teach or suggest the optimal restoration of a route between nodes in a SkipNet overlay network implemented in a multicast infrastructure while maintaining compliance with the path locality requirement. Here, a route between two nodes may be restored as long as intermediate nodes in a restored route only forward messages to nodes in the same administrative domain. For example, a route between a subscriber node and a root node of the multicast tree forward subscription messages only to nodes belonging to the same organization as the subscriber node and the root node.

In contrast, the Applicants' invention, as recited in amended claim 1, is:

> 1. A carrier computer-readable memory medium storing program instructions executable to implement a method comprising:
> determining an ordering for a plurality of N nodes such that the nodes are circularly ordered as nodes D_0, D_1, D_2, ... D_{N-1};
> each node D_i in the plurality of nodes establishing a link: to X other nodes chosen as nodes D_{i+1}, D_{i+2}, ... D_{i+X}, wrapping to D_0 if necessary; and
> each node D_j in at least a subset of the plurality of nodes establishing a link with one or more additional chosen nodes not in the set D_{j-X}, D_{j-X+1}, ... D_{j-1}, D_{j+1}, D_{j+2}, ... D_{j+x}; and
> for each node D_j in the at least the subset, each node in the set D_{j-X}, D_{j-X+1}, D_{j+1}, D_{j+2}, ... D_{j+X} establishing a link with the one or more additional nodes chosen by the node D_j.

The cited references, singularly or in any conceivable combination, do not teach or suggest each and every claimed limitation of the Applicants' invention, as recited in independent claim 1. First, the cited references cannot be combined in any reasonable manner to teach or suggest the claimed limitation *each node D_i in the plurality of nodes establishing a link: to X other nodes chosen as nodes D_{i+1}, D_{i+2},...D_{i+X}, wrapping to D_0 if necessary*. None of the cited references teach or suggest a plurality of nodes in a circular ordering where links are established between a first node and X nodes to the right of the circular ordering and between the first node and X nodes to left of the circular ordering. Hence, the node D_i is connected to nodes D_{i+1}, D_{i+2},...D_{i+X} and to

nodes D_{i-1}, D_{i-2}, ... D_{i-X}. Consequently, the cited references do not teach or suggest the establishment of links in such a manner.

The Office incorrectly cites Harvey at Figure 9 as a teaching or suggestion of the claimed limitation. As stated in Harvey, Figure 9 illustrates a "perfect" SkipNet. See Harvey, para [0163]. However, a SkipNet is not equivalent to the plurality of nodes as claimed by the Applicants. As disclosed by Harvey, a first node in the SkipNet is configured to skip 2^h nodes when establishing links at level (height) h. See Harvey, para [0160]-[0163]. In other words, the first node establishes links with nodes that are 2^h nodes away from the first node for each level h. Clearly, the first node in the SkipNet does not establish links with each node within X nodes to the right and X nodes to the left of the first node in a circular ordering of the nodes in the overlay network.

The Office further states that at level h=0, the SkipNet as taught by Harvey and depicted in Figure 10 teaches a first node that establishes links with X nodes to the right and X nodes to the left in a circular ordering. See Non-Final Office Action, pg. 9. Specifically, the Office cites the bottom ring at case level L=0 in figure 10 of Harvey as a teaching of a plurality of nodes in a circular ordering where each node establishes links with one (X=1) node to the left and one (X=1) node to the right. See Id. The Applicants' respectfully disagree.

The Office incorrectly asserted that the SkipNet of Harvey permits an SkipNet where h=0. Harvey unambiguously states that "each SkipNet node stores roughly 2 log N pointers, where N is the number of nodes in the overlay system." See Harvey, para [0162]. In addition, Harvey states "In a skip net, to be distinguished from a skip list as just discussed, every node preferably has height log n…. " See Harvey, at para [0064]. With respect to Figure 10, each node within the SkipNet stores roughly six pointers (2 log 8 = 6) and preferably has a height of (log 8=3). As described in Harvey for Figure 10, each node in the bottom ring only stores two pointers and has a height of one. Furthermore, the rings in Figure 10 are arranged in levels to show all node interconnections at every level of the SkipNet of Figure 9 simultaneously. Therefore, the bottom ring (h=0) by itself is not a complete or permissible SkipNet because each pointer has a length of one and no node is skipped.

Harvey states that "a pointer at level h still skips over 2^h nodes in expectation, and routing is possible in O(log N) forwarding hops with high probability." See Harvey, at para [0163]. The Applicants' respectfully submit that a SkipNet with a height of zero cannot achieve O(log N) complexity for searching the nodes because none of the nodes will be skipped. As such, each node in the SkipNet where h=0 are to be searched before the correct node is found. On the other hand, if a pointer at level h traverses 2^h nodes, then fewer nodes are to be searched before the correct node is found.

Furthermore, Harvey states that "one could arrange all nodes in the overlay network into a lexicographically sorted linked list (a 'base ring'), and that would suffice in order to route a message to its-correct final destination. However, it would be slow, taking O(N) steps where N is the number of nodes in the overlay network. One can improve routing performance by maintaining multiple rings that "skip" over various members of the lexicographically sorted list of all nodes. These additional rings allow one to find the desired end destination node more quickly. An organization having multiple rings enables routing to be completed in O(log n) forwarding steps instead of the O(N) steps required if only the base ring was maintained." See Harvey, at para [0065]-[0066]. Accordingly, Harvey discourages a SkipNet where h=0 because such a SkipNet would be equivalent to the inefficient base ring.

Harvey, however, does not teach that each node in the SkipNet only store pointers for a first node to the left and a first node to the left as proposed by the Office. In other words, each node (including the first node) in the SkipNet depicted in Figure 10 establishes links with a first, a second and a fourth node node to the left and a first, a second and fourth node to the right; whereas, the Applicants' invention as claimed in independent claim 1 recites that each node establishes a link with X nodes to the left and X nodes to the right. Thus, the cited references do not teach or suggest the above claimed limitation.

Second, the cited references cannot be reasonably combined to teach or suggest the claimed limitation *each node D_j in at least a subset of the plurality of nodes establishing a link with one or more additional chosen nodes not in the set D_{j-X}, D_{j-X+1}, ... D_{j-1}, D_{j+1}, D_{j+2}, ... D_{j+x}*. The set D_{j-X}, D_{j-X+1},...D_{j-1}, D_{j+1}, D_{j+2},... D_{j+x} refers to the set of nodes to which the node D_j has already established a link. Hence, the node Dj is

establishing a link with one or more nodes that are not already linked to the node Dj. The cited references, however, do not teach or suggest establishing a link between nodes that are not already connected to each other. For example, the cited references teach that paths or links between nodes in a multicast infrastructure utilizing SkipNet overlay networks cannot be established if the path locality requirements inherent in the SkipNet design are not satisfied as a result. See Dunagan para [0057]-[0063].

The SkipNet designed overlay network as taught by the cited references discourages the establishment of links between the first node and nodes that are not 2^h nodes away for each level h because it disrupts the probability of routing in O (log N) forwarding hops. See Harvey para [0061]-[0066] and [0163]-[0166]. Hence, the cited references do not teach or suggest the above claimed limitation. With respect to independent claim 17, since the cited references do not teach or suggest establishing a link between node Dj and *any node* not in the set D_{j-X}, D_{j-X+1},...D_{j-1}, D_{j+1}, D_{j+2},... D_{j+x}, the cited references cannot teach or suggest establishing a link with a randomly chosen node not in the above set. Accordingly, the cited references, singularly or in any conceivable combination, do not teach or suggest each and every claimed limitation as recited in independent claims 1 and 17.

Independent claims 17, 18 and 19 recite features similar to independent claim 1. Furthermore, dependent claims 3-16 and 21-29 depend, either directly or indirectly, from independent claims 1, 17, 18 and 19. As such and for the same reasons set forth above, the Applicants submit that none of these claims is obvious with respect to the teachings of the cited references. Therefore, the Applicants submit that all these dependent claims also fully satisfy the requirements of 35 U.S.C. § 103 and are patentable thereunder.

CONCLUSION

In view of the foregoing, the Applicants submit that none of the claims presently in the application are obvious under the provisions of 35 U.S.C. §103. Consequently, the Applicants believe that all these claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Office believes that any unresolved issues still exist or if, in the opinion of the Office, a telephone conference would expedite passing the present application to issue, the Office is invited to call the undersigned attorney directly at 732-917-6320 or the office of the undersigned attorney at 732-978-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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